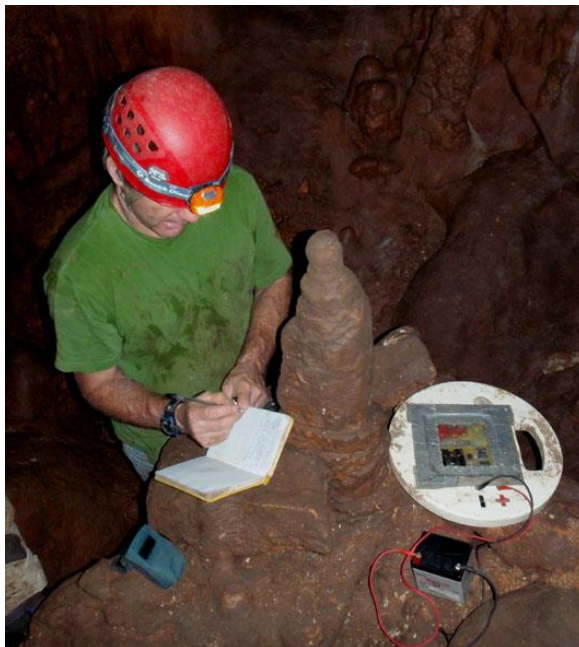
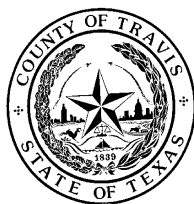


**Balcones Canyonlands Preserve
Karst Monitoring and Management
FY 2013 Annual Report**



Nico Hauwert setting up a cave radio to verify the accuracy of the cave map of Maple Run Cave, Travis County.
Photo by Mark Sanders

**Travis County
Department of Transportation and Natural Resources
Natural Resources and Environmental Quality Division
and
City of Austin BCP – Austin Water Utility (AWU)**



October 1, 2012 – September 30, 2013

TABLE OF CONTENTS	PAGE
1.0 REGIONAL PERMIT	1
2.0 CAVE MANAGEMENT SUMMARY	2
3.0 OWNERSHIP AND PROTECTION STATUS	7
4.0 ACCESS STATUS AND KARST EDUCATION	15
5.0 MANAGEMENT COORDINATION	21
6.0 BIOLOGICAL MONITORING	22
7.0 HYDROGEOLOGICAL STUDIES	26
8.0 RECOMMENDATIONS	28
9.0 KARST MANAGEMENT ACTIVITIES.....	29
10.0 LITERATURE CITED	38

TABLES:

TABLE 1: Endangered karst invertebrate locations in BCCP caves	3
TABLE 2: Endangered karst invertebrate locations in non BCCP-listed karst features	6
TABLE 3: Ownership, protection, monitoring and access status of the 62 BCCP karst features.....	8
TABLE 4: FY13 BCCP karst feature monitoring and management activities	29

EXHIBIT A: KARST FAUNAL SURVEY REPORTS:	40
TRAVIS COUNTY (28 REPORTS)	
CITY OF AUSTIN (36 REPORTS)	
TRAVIS COUNTY/CITY OF AUSTIN (6 REPORTS)	
EXHIBIT B: CAVE CRICKET EXIT COUNT DATA REPORTS:.....	45
TRAVIS COUNTY (18 REPORTS)	
CITY OF AUSTIN (33 REPORTS)	

1.0 REGIONAL PERMIT

There are six species of endangered karst invertebrates (ES) and 25 karst species of concern (SOC) covered by the Balcones Canyonlands Conservation Plan (BCCP), a regional 10(a)1(B) permit issued by the U.S. Fish and Wildlife Service (USFWS) to the City of Austin (COA) and Travis County (TC) in May 1996 (USFWS, 1996a). If these 25 species of concern become listed as endangered in the future, no additional mitigation will be necessary to protect them, provided that all karst protection requirements, outlined in the BCCP, are fully implemented.

The Regional Permit requires protection of 35 endangered species caves and 27 additional caves that support SOC, for a total of 62 karst features (60 caves, one mine and one karst spring). Several of these karst features occur in clusters, identified in the Regional Permit as the Jollyville, McNeil, and Northwood cave clusters. As of Fiscal Year 2013 (FY13), 30,520 acres have been acquired for the Balcones Canyonlands Preserve (BCP). Forty-seven of the 62 BCCP karst features have some form of formal protection within these BCP tracts, which include properties owned and managed by COA, TC, and BCCP partners, as well as private mitigation lands.

The six species of endangered karst invertebrates in Travis County are:

Tooth Cave pseudoscorpion	<i>Tartarocreagris texana</i>	Kretschmarr Cave mold beetle	<i>Texamaurops reddelli</i>
Tooth Cave spider	<i>Neoleptoneta myopica</i>	Bee Creek Cave harvestman	<i>Texella reddelli</i>
Tooth Cave ground beetle	<i>Rhadine persephone</i>	Bone Cave harvestman	<i>Texella reyesi</i>

The 25 additional karst species of concern to be protected by the regional permit are:

FLATWORMS	<i>Sphalloplana mohri</i>	PSEUDOSCORPIONS	<i>Aphrastochthonius</i> N. S.
OSTRACODS	<i>Candona</i> sp. Nr. <i>Stagnalis</i>		<i>Tartarocreagris comanche</i>
SPIDERS	<i>Cicurina bandida</i>		<i>Tartarocreagris reddelli</i>
	<i>Cicurina cueva</i>		<i>Tartarocreagris intermedia</i>
	<i>Cicurina ellioti</i>		<i>Tartarocreagris</i> N. S. 3
	<i>Cicurina reddelli</i>	HARVESTMEN	<i>Texella spinoperca</i>
	<i>Cicurina reyesi</i>	GROUND BEETLES	<i>Rhadine s. subterranea</i>
	<i>Cicurina travisae</i>		<i>Rhadine s. mitchelli</i>
	<i>Cicurina wartoni</i>		<i>Rhadine austinica</i>
	<i>Neoleptoneta concinna</i>	ISOPODS	<i>Caecidotea reddelli</i>
	<i>Neoleptoneta devia</i>		<i>Trichoniscinae</i> N. S.
	<i>Eidmannella reclusa</i>		<i>Miktoniscus</i> N. S.
MILLIPEDES	<i>Speodesmus</i> N. S.		

2.0 CAVE MANAGEMENT SUMMARY

This annual report covers the fiscal year 10/01/12-9/30/13 (FY13). In FY13, the BCCP partners continued efforts to determine and track the status of the 62 karst features covered by the BCCP 10(a) permit. The permit holders continued efforts to acquire, protect, and monitor the karst species in the caves included in the Permit (Tables 1 and 3).

A total of 47 of the BCCP caves are “protected” in some way, with 15 “unprotected”. The 47 “protected” BCCP caves are currently managed as follows: 21 caves protected as part of the BCP on COA land; one cave protected on The Nature Conservancy (TNC) land; 12 caves protected as part of the BCP on TC land; two caves protected on Texas Cave Management Association (TCMA) land; seven caves protected as part of private Section 10(a) or Section 7 agreements with USFWS; and four caves that have protection agreements that include development setbacks from the cave entrance. Some of these “protected” caves only have protected entrances, but are threatened by surrounding development or planned development. Protection status of each of the 62 BCCP caves is detailed in Table 3 below.

In addition to protecting and monitoring caves covered by the BCCP permit, COA and TC also provide protection for other karst features found on the BCP containing ES and SOC. Some of these additional karst features are incorporated into TC and COA’s shared biological monitoring program, as described in Section 6.0. As of FY13, 12 endangered species karst features which were not listed on the original permit are being protected on BCP lands (six features on TC BCP; six features on COA BCP; Table 2).

To assist with analyzing the adequacy of the current preserve design for each karst feature, including the amount of surface and subsurface habitat needed to support these ecosystems, the COA and TC have been working together to maintain a comprehensive database for the 62 features and other features identified within the BCP since the regional permit was issued in 1996. The database also incorporates monitoring data and management issues for each karst feature. The karst database is discussed in more detail in Section 5.0.

Table 1. Endangered Karst Invertebrate Locations within BCCP caves of Travis County, Texas. This table was originally in the BCCP permit in 1996 and was revised to show new species location information from James Reddell (2004, 2005, 2010), HNTB (2005), Cokendolpher (pers com, 2008), USFWS (2009a,2009b, 2009c), and Ledford (2010).

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Neoleptoneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Amber Cave	BCP Jollyville/TC	Jollyville Plateau	X 1996		X 2010 (Reddell)	X 1996		
Bandit Cave	Private	Rollingwood					P 1996	
Beard Ranch Cave	BCP Ivanhoe/COA	Jollyville Plateau						X 1996
Bee Creek Cave	Private	Rollingwood					X 1996	
Beer Bottle Cave	Not required to be protected under BCCP	McNeil/Round Rock						X 1996
Broken Arrow Cave	BCP Lime Cr. Prs./COA	Cedar Park			X 1996			
Cave Y	BCP Barton Creek Grblt/COA	Rollingwood					P 1996 delete P (Reddell 2004)	
Cold Cave	Private	McNeil/Round Rock						X 1996
Cotterell Cave	BCP Spicewood Spgs. Pk./COA	Central Austin						X 1996
Disbelievers Cave	BCP Private 10(a)	Jollyville			X 1996			
Eluvial Cave	BCP Private 10(a)	Jollyville						X 1996
Fossil Cave	BCP Schroeter Pk./COA	McNeil/Round Rock						X 1996
Fossil Garden Cave	Private	McNeil/Round Rock						X 1996
Gallifer Cave	BCP Jollyville/TC	Jollyville Plateau		P 1996 X 2010 (Ledford)	P 1996 X 2005	X 2009 (Chandler)		X 1996

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Neoleptoneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
Hole-in-the-Road	Private	McNeil/Round Rock						X 1996
Japygid Cave	BCP Private 10(a)	Jollyville			X 1996	P 1996 X 2005		
Jest John Cave	BCP Forest Ridge/COA	Jollyville Plateau					X 1996	
Jester Estates Cave	BCP Forest Ridge/COA	Jollyville Plateau	X 2008 (Cokendolpher)	X 2010 (Ledford)			X 1996	
Jollyville Plateau Cv.	BCP Private 10(a)	Jollyville			X 1996			X 1996
Kretschmarr Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996	X 1996		
Kretschmarr Dble. Pit	BCP Jollyville/TC	Jollyville Plateau	P 1996 X 2005		P 1996 X 2005		P 1996	
Lamm Cave	Private Section 7	Jollyville Plateau			X 1996			
Little Bee Cr. Cave	BCP Ullrich WTP/COA	Rollingwood					X 1996	
McDonald Cave	BCP Jollyville/TC	Jollyville Plateau						X 1996
McNeil Bat Cave	Private	McNeil/Round Rock		X 2010 (Ledford)				X 1996
Millipede Cave	Not Protected under BCCP	McNeil/Round Rock						X 1996
M.W.A. Cave	BCP Private 10(a)	Jollyville	P 1996 X 2005		X 1996	P 1996 X 2005		X 1996
New Comanche Tr. Cave	BCP Lake Travis/TC	Jollyville Plateau		X 1996				X 1996
No Rent Cave	Private	McNeil/Round Rock						X 1996

Cave Name	Current Preserve Status	Karst Fauna Region	Tooth Cave Pseudoscorpion <i>Tartarocreagris texana</i>	Tooth Cave Spider <i>Neoleptoneta myopica</i>	Tooth Cave Ground Beetle <i>Rhadine persephone</i>	Kretschmarr Cave Mold Beetle <i>Texamaurops reddelli</i>	Bee Creek Cave Harvestman <i>Texella reddelli</i>	Bone Cave Harvestman <i>Texella reyesi</i>
North Root Cave	BCP Jollyville/TC	Jollyville Plateau			X 1996			
Puzzle Pits Cave	Not required to be protected under BCCP	Jollyville			X 1996			
Rolling Rock Cave	BCP Lime Cr.Pr./COA,Sec.10(a)	Cedar Park			X 1996			
Root Cave	BCP Jollyville/TC	Jollyville Plateau		X 2010 (Ledford)	X 1996			X 1996
Spider Cave	BCP Park West/COA	Jollyville Plateau			X 2004 (Reddell)		X 2004 (Reddell)	P 1996 delete P 2004 (Reddell)
Stark's North Mine Cave	BCP Stark's/TC						X 2009 (USFWS)	
Stovepipe Cave	BCP Canyon Creek/ COA	Jollyville Plateau	P 1996 delete P 2005 (Reddell) *	P 1996 delete P 2010 (Ledford)	X 1996	X 1996		P 1996 X 2009 (USFWS)
Tardus Hole	BCP Jollyville/TC	Jollyville Plateau			X 1996	X 2009 (Chandler)		
Tooth Cave	BCP Jollyville/TC	Jollyville Plateau	X 1996	X 1996	X 1996	X 1996		X 1996
Weldon Cave	Private	McNeil/Round Rock						X 1996
West Rim Cave	Not Protected under BCCP	Central Austin						X 1996

Sources: BCCP Permit 1996, Elliott 1992, USFWS 1994, Reddell 2004 and 2005, HNTB 2005, USFWS 2009a, 2009b, Ledford 2010

X 1996 = confirmed occurrence based on collected specimen, the designation in the 1996 BCCP permit

P 1996 = probable occurrence based on observation but not confirmed with collected specimen, the designation in 1996 BCCP permit

X 2005 = was listed as confirmed in the HNTB summary of James Reddell's data, 2005 report for USFWS

Tentative 2005 = was listed as tentative in the HNTB summary of Reddell's data, 2005 report for USFWS

Delete P 2004 (Reddell) = this species is no longer thought to occur in this cave (personal communication Reddell 2004)

* Reddell (pers com 2005) reported that *Tartarocreagris texana* does NOT occur in Stovepipe Cave. The species there is *Tartarocreagris altimana*, known only from that cave.

X 2008 = Cokendolpher (pers com 2008) confirmed that Jester Estates Cave is a new site for *Tartarocreagris texana*

X 2009 = USFWS - according to the 2009 5 year review on *Texella reyesi* the report lists *T. reyesi* as confirmed for Stovepipe Cave; *Texella reddelli* 5-year review confirms *T. reddelli* for Stark's North Mine (USFWS 2009c).

X 2009 (Chandler) = confirmed by D. Chandler, as reported in USFWS 5-year review (2009b).

X 2010 (Ledford) = confirmed by J. Ledford (pers com 2010)

Delete P 2010 (Ledford) = *Neoleptoneta* for stovepipe was confirmed as *N devia* (personal communication J. Ledford 2010)

X 2010 (Reddell) = confirmed by J. Reddell (pers com 2010)

Table 2. Non BCCP-listed Caves/karst features with Endangered Karst Invertebrates protected on the BCP of Travis County, Texas.

Cave/Karst Feature Name	Current Owner	Karst Fauna Region	Endangered karst invertebrates confirmed
Cortana Cave	COA	Jollyville Plateau	<i>Neoleptoneta myopica</i> <i>Texella reyesi</i>
Down Dip Sink	COA	Jollyville Plateau	<i>Rhadine persephone</i>
Garden Hoe Cave	COA	Jollyville Plateau	<i>Rhadine persephone</i>
Geode Cave	TC	Jollyville Plateau	<i>Neoleptoneta myopica</i> <i>Rhadine persephone</i> <i>Texella reyesi</i>
IV-3	COA	Jollyville Plateau	<i>Texella reyesi</i>
LU-11	TC	Jollyville Plateau	<i>Neoleptoneta myopica</i>
LU-12	TC	Jollyville Plateau	<i>Texella reyesi</i>
Merkin Hole	COA	Jollyville Plateau	<i>Texella reddelli</i>
Pond Party Pit	COA	Jollyville Plateau	<i>Texella reyesi</i>
RI-1	TC	Jollyville Plateau	<i>Texella reddelli</i>
Tight Pit Cave	TC	Jollyville Plateau	<i>Neoleptoneta myopica</i>
Two Trunks Cave	TC	Jollyville Plateau	<i>Rhadine persephone</i>

3.0 OWNERSHIP AND PROTECTION STATUS

Many karst features listed in the BCCP permit have adequate protection, based on the criteria outlined in USFWS's *Karst Preserve Design Recommendations* (USFWS 2012). However, some caves listed in Table 3 as "protected" under individual USFWS Section 10(a) or Section 7 permits may not be adequately protected as defined in USFWS (2012). Efforts are being made by the BCCP Permit Holders to contact owners of privately owned caves to assess their protection efforts and to assist them with protection where possible.

Though not a requirement of the BCCP permit, the updated USFWS karst preserve design recommendations direct that the protected area surrounding the cave should be at least 16–40 ha (40-99 acres) in size to capture the majority of plant and animal community elements needed to support the karst ecosystem, as well as protect the cave footprint and surface/subsurface drainage basins of the cave (USFWS 2011a). Some caves within the BCP meet or exceed these recommendations, while others do not, due to conditions that existed before the Permit was issued, such as pre-existing development in the form of subdivisions, roads, power lines, and septic lines that preclude complete protection of the recommended preserve areas. BCCP Permit Holders will continue to do what is reasonable to protect these features from pre-existing development and continue efforts to acquire and protect the karst features listed in the BCCP permit.

In FY13, COA/TC staff performed new analyses to determine protection status for BCCP caves and other BCP-owned endangered species caves/karst features using criteria based on Preserve Components defined in USFWS *Karst Preserve Design Recommendations* (USFWS 2012). The results from these analyses will benefit BCCP Permit Holders in prioritizing acquisition and protection efforts for BCCP caves and surrounding lands, as well as assist USFWS in determining whether some of these protected BCP caves can meet their recovery criteria and be considered protected KFAs.

Table 3. FY13 Ownership, protection, monitoring and access status of the 62 BCCP caves/karst features (35 caves with ES and 26 caves with SOC) ^{1, 2}.

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Adobe Springs Cave	SOC	BCP/TNC		Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Airmen's Cave	SOC	BCP/COA	Gated	Protected on parkland	COA twice weekly surface monitoring (volunteers check on gate); bi-annual cave cricket exit counts; bi-annual species monitoring	Access by permit
Amber Cave	ES	BCP/TC	Gated and fenced	Protected on preserve (very close to road and sewer line)	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; red-imported fire ant (RIFA) survey/ control; bi-annual species monitoring	none
Armadillo Ranch Sink	SOC	Private		Private - Unknown		none
Arrow Cave	SOC	BCP/COA	Gated	Protected in parkland (There are nearby homes immediately south of the cave entrance)	COA quarterly surface monitoring; annual species monitoring	none
Bandit Cave	ES	Private	Gated	Protected by private ecologically concerned landowner		none
Beard Ranch Cave	ES	BCP/COA		Protected on preserve	COA quarterly surface monitoring; annual faunal survey	none
Bee Creek Cave	ES	Private		Private- Unknown		none
Blowing Sink Cave	SOC	BCP/COA	Gated	Protected on preserve	COA semi-monthly surface and annual species monitoring; RIFA control	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Broken Arrow Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Buda Boulder Spring	SOC	BCP/COA		Protected in parkland (close proximity to a hike and bike trail)	COA bi-annual surface monitoring; annual species monitoring	none
Cave X	SOC	Private/COA Protection Agreement	Gated and fenced	Protected by landowner with 4.5 acre setback to protect cave footprint. Protected to some extent (not actively managed and the setback is inadequate).	Occasional species and surface monitoring by COA. WPD (Watershed Protection Division) is currently negotiating with property owner to increase monitoring and management of the cave as part of an agreement to allow for on site construction of a berm to reduce flooding concerns	none
Cave Y ¹	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface bi-annual species monitoring; bi-annual cave cricket exit counts; RIFA control	none
Ceiling Slot Cave	SOC	Private		Private - Unknown		none
Cold Cave	ES	Private	Gated	Private - Unknown	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Cotterell Cave	ES	BCP/COA	Gated and fenced	Protected in parkland. (There are nearby homes immediately east of the cave entrance)	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Disbelievers Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
District Park Cave	SOC	BCP/COA	Gated	Protected in parkland	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	1 st room open, past 1 st room protected by gate, access by permit*
Eluvial Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Flint Ridge Cave	SOC	BCP/COA	Gated	Protected on Water Quality Protection Land (drainage basin will be negatively impacted by the construction of a proposed highway, if constructed.)	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Fossil Cave	ES	BCP/COA	Access protected by large rocks	Protected in parkland	Exact location of cave is unknown. COA quarterly surface monitoring	None
Fossil Garden Cave	ES	Private		Private - Unknown	Occasional COA and TC species Monitoring	none
Gallifer Cave	ES	BCP/TC	Gated and fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Get Down Cave	SOC	Private/COA Protection Agreement	Gated and fenced	Protected with Protection Agreement - Inadequate setback from development.		none
Goat Cave	SOC	BCP/COA	Fenced	Protected on preserve	COA weekly surface monitoring; annual species monitoring; RIFA control	access by permit*
Hole-in-the-Road	ES	Private		Private –Unknown. (very close to a major roadway)	Occasional COA species monitoring	none
Ireland's Cave	SOC	BCP/ TC	Gated	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Jack's Joint	SOC	Private		Private - Unknown		none
Japygid Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Jest John Cave	ES	BCP/COA		Protected on preserve	COA cave cricket exit count; bi-annual surface monitoring	none
Jester Estates Cave	ES	BCP/COA	Gated and fenced	Protected on preserve (3.2 acre preserve surrounded by homes).	COA monthly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Jollyville Plateau Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		none
Kretschmarr Cave	ES	BCP/TC	Gated and fenced	Protected on preserve. Close to roadway and in power line ROW.	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Kretschmarr Double Pit	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Lamm Cave	ES	BCP/Private Section 7	Gated and fenced	COA negotiated setback (approximately 150')	Occasional surface and species monitoring by COA	none
Little Bee Cr. Cave	ES	BCP/COA	Gated	Protected by COA AWU Dept.	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	none
Lost Gold Cave	SOC	Private	Gated	Private – Unknown (new owner); may be development near cave entrance		none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Lost Oasis Cave	SOC	Private/TCM A	Gated and fenced	Protected by TCMA	Sporadic species and surface monitoring by TCMA	controlled access**
M.W.A. Cave	ES	BCP/Private Section 10(a)		Protected by 10a permit, hired Plateau Land & Wildlife Management		
Maple Run Cave	SOC	BCP/COA	Gated	Protected on preserve	COA weekly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	access by permit*
McDonald Cave	ES	BCP Jollyville/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	None
McNeil Bat Cave	ES	Private		Private – Unknown (close proximity to high school)	Occasional COA and TC species monitoring	none
Midnight Cave	SOC	BCP/COA	Fenced	Protected on parkland (close proximity to soccer fields)	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	access by permit*
Moss Pit	SOC	Private		Private - Unknown		none
New Comanche Trail Cave	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; Annual species monitoring	none
No Rent Cave	ES	Private		Private - Unknown	TC/COA occasional species monitoring	none
North Root Cave	ES	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Pennie's Cave	SOC	Private		Landowner has filled entrance. WPD has negotiated to excavate the entrance and add a cave gate, as well as adding a 300 ft buffer around the cave.		none
Pickle Pit	SOC	BCP/Private Sec. 7	Gated	TC staff in early negotiations worked with property owner on a possible MOU or management agreement.	COA, Loomis staff, and USFWS conducted two cave faunal surveys.	none
Pipeline Cave	SOC	Private	Gated	WPD have negotiated a small setback from future platted development.		none
Rolling Rock Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface and annual species monitoring; RIFA control	none
Root Cave	ES	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Slaughter Creek Cave	SOC	BCP/COA	Gated	Protected on parkland (Nearby homes are immediately south of cave entrance)	COA quarterly surface and annual species monitoring; RIFA control	none
Spanish Wells	SOC	Private		Private- Unknown		none
Spider Cave	ES	BCP/COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Stark's North Mine	ES	BCP/TC		Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none

Cave Name	ES or SOC	BCP or Private/ Current Owner	Gated/ Fenced	Protection Area Status /Adequate Preserve size	Species Monitoring Status	Public Access
Stovepipe Cave	ES	BCP/ COA	Fenced	Protected on preserve	COA quarterly surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring; RIFA control	none
Talus Springs Cave ²	N/A	BCP/Private Section 10(a)	Gated	Protected by Homeowners Association and TC, only has 50' setback from houses and is probably affected by uphill development.	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Tardus Hole	ES	BCP/TC	Fenced	Protected on preserve	TC bi-annual surface monitoring; RIFA survey/control; annual species monitoring	none
Tooth Cave	ES	BCP/TC	Gated and Fenced	Protected on preserve	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; RIFA survey/control; bi-annual species monitoring	none
Weldon Cave	ES	Private		Private - Unknown	TC bi-annual surface monitoring; bi-annual cave cricket exit counts; bi-annual species monitoring	None
Whirlpool Cave	SOC	Private/ TCMA	Gated	Protected by TCMA	TCMA routine surface monitoring; COA/TC quarterly species monitoring to assess tawny crazy ant impacts	controlled access**

¹ Cave Y was considered an ES cave (*Texella reddeni*) in the 1996 BCCP Permit, but has since been determined not to contain *Texella reddeni* (Reddell 2004).

² Talus Springs Cave has never been known to contain ES or SOC. This cave was placed on the BCCP permit because it contained the amphipod *Stygobromus birfurcatus*, originally considered as a SOC candidate; however, *S. birfurcatus* was not included in the Permit's final list of 25 SOC karst species to be protected.

* Access by Permit - Permit may be issued by COA – Austin Water Utility or Austin Parks and Recreation Department (PARC) staff.

** Controlled Access - Private cave owners control the access.

4.0 ACCESS STATUS AND KARST EDUCATION

The *Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management* (2007) describes the need for public education as follows:

- “Public education is essential for the continued existence and recovery of karst invertebrates.”
- “Public Education includes literature, curriculum, guided surface and subsurface tours that can be made available for the general public, agencies, and individuals interested in learning more about karst areas and their inhabitants.”
- “A higher public awareness is an important step for the recovery of the endangered cave invertebrates and preservation of species of concern.”
- “Need to control public access (cave gates) and monitor for impacts to species.”

Public education on caves and cave ecosystems is recognized as vital for karst species preservation in the Karst Land Management Plan. Currently, most opportunities for children to enter caves and learn about cave ecosystems is through programs provided by COA WPD and Austin Nature and Science Center summer camps. Adult wild cave tours in the Austin area are not widely available, although many tours are conducted through TCMA and University of Texas Grotto. Overall there is more demand for cave education than can be met with existing programs.

One factor limiting cave education is a deficit of caves suitable for cave immersion, particularly considering the high demand and its effectiveness as both a teaching tool and management practice to support stewardship for cave ecosystems. Cave education/recreation primarily occurs in 10% of the BCCP permit caves, which have been used for this purpose prior to the 1996 permit. Whirlpool Cave (owned and managed by TCMA) likely has the highest traffic of all the BCCP caves, exceeding 1,152 person trips in FY13. Although studies on human impacts to cave ecosystems are limited, it is assumed that high human traffic in a cave may negatively impact the cave fauna.

In response to the potential negative impacts to BCCP permit caves, BCP staff met on January 10, 2013 with local educators (COA PARD, WPD Education, TCMA, and BS/EACD staff) to review existing cave access/ public education issues. The primary focus of the meeting was to review existing policy to see if current access policy was having a detrimental impact to BCP permit caves, and if so, try to determine ways to mitigate this damage. To address the overuse issue, WP staff are currently looking for new caves that could be used in lieu of BCP permit caves. Also, TCMA have initiated a policy of charging for access, this action may reduce total access numbers to Whirlpool Cave.

Another heavily-used cave is Wildflower Cave, a relatively small non-BCCP cave on the Lady Bird Johnson Wildflower Center that received 1,572 visitors in FY13. Wildflower Cave has been used for education by COA Earth Camp since 1997 after restoration efforts in 1994-1995. Wildflower Cave is unsuitable for many cave tours due to its currently limited extent and small size, but is heavily utilized in 5th grade Earth Camp cave education (see Cave Education Summary below).

Restoring Non-BCCP Caves for Education

By developing non-BCCP caves to be safe and accessible for adequately trained and responsible groups to use for guided education/recreational tours, we can promote education while reducing BCCP cave impacts. Non-BCCP education caves should draw traffic from BCCP caves and provide a greater range of experience. In FY13, large progress was made in developing non-BCCP caves for educational use, due to COA WPD funding the creation of a team of cave specialists to excavate caves of trash, ranch fill, and eroded sediment. Education cave development was also funded by WPD education and Water Resource Evaluation divisions. The team (consisting of geologist Bev Shade, Heather Tucek, Justin Shaw, Christopher Francke, David Ochel, landscape architect Vivian Loftin, Don Broussard, Guin McDaid, Galen Falgout, David Comer, Yaz Avila, and Drew Thompson) contributed to the following cave restoration projects:

La Crosse Cave at the University of Texas Lady Bird Johnson Wildflower Center had extensive excavation in FY13, through the WPD cave team, Wildflower Center landscape manager Philip Schulze, and cave-trained volunteers. Over 1,500 cubic feet of rock, soil, glass, and ranch debris were removed. Wildflower Cave was also extended and mapped to a lower level.

Wade Sink in the Goat Cave Karst Preserve (owned by COA PARD) was excavated and extended into a multi-level cave. COA WPD staff also attempted to open the entrance of Grassy

Cove Cave on COA PARD greenbelt, but were unsuccessful in removing several large boulders blocking the entrance.

Bowie High School Cave was excavated during the summer of 2013 under an interlocal agreement between COA WPD and Austin Independent School District (AISD). Additional excavation and access improvements that may be funded to occur in FY14 are necessary before student tours can be provided. Development of Bowie High School Cave will provide cave education opportunities and help divert unauthorized traffic from the nearby Blowing Sink BCP preserve. For outstanding efforts toward restoring Bowie High School Cave over 20 years, Bowie High School science teacher Jill Harding received an education award from the Barton Springs/Edwards Aquifer Conservation District (BS/EACD) in 2013.

McNeil High School is located within the McNeil BCCP cave cluster, and its courtyard contains two caves with ES: **Millipede Cave and Millipede Annex Cave**. In FY13, cave specialists worked with McNeil HS science teacher Tina Vick to consider if specialized and proactive management could improve the courtyard cave ecosystem while providing vital cave education. COA WPD staff drafted a landscape design for vegetation of the courtyard that would increase nutrients for cave crickets. Bi-annual cave faunal surveys were also conducted by TC/COA BCP staff. One cave cricket exit count was also conducted in Spring 2013.

The Village of Western Oaks Karst Preserve was developed in 1998 by Lumbermans (now Forestar Realty). This preserve contains one BCCP cave (Get Down Cave), is the site of a locally cherished annual Cave Day festival, and contains a number of additional non-BCCP caves suitable for public education. Intended acquisition by COA has been delayed since 1998 due to disagreements on repairing a water-quality wet pond on the preserve. In FY13, the Village of Western Oaks Homeowners Association board completed their review of the draft agreement with COA, and it appears likely that a final transfer will be completed in early 2014.

BCP Cave Preserve Restoration

In FY13, COA WPD, in cooperation with COA BCP and PARD staff conducted sinkhole and cave restoration on five project sinkholes (Sink in the Woods/Williams Well, Brownlee, Winter Woods, Wyoka, and Sinky Dinky) on the Blowing Sink Preserve. After a rescue of two 18-year old students from Blowing Sink Cave in February 1991, volunteer cavers under leadership of William Russell installed wooden structures in these five sinks to keep people out. After 20 years the temporary emergency structures are failing, allowing the collapse of unstable sediment slopes that contribute to obstructing recharge as the caves plug. In addition, several of the sinks are once again gaping open as a public safety hazard. The caves are within the subsurface catchment area

and are known to contribute recharge to Blowing Sink Cave, a BCCP cave. COA WPD dedicated Capital Improvements funds to restore the five sinkholes. From February 2013 through May 2013, the COA WPD cave team excavated sediment fill from Sinky Dinky, Brownlee, and Sink in the Woods/Williams Well. Zara Environmental LLC was contracted to initiate sinkhole restoration in FY14.

FY13 Access Status

In FY13, 416 visitors were issued access permits by COA BCP staff to COA BCCP caves for educational/recreational/rescue training including: Airmen's cave (178), District Park Cave (134), Goat Cave (57), and Maple Run (47). See Table 3 for access and gating status of all of the BCCP caves.

FY 2013 Cave Education Summary

COA Youth Education Programs

COA WPD conducts cave education through Earth Camp and Earth School (fifth grade water quality programs), Clean Creek Camp (a summer parent/child water quality program), Hydrofiles (a high school water quality program), and adult education such as Groundwater to the Gulf: Summer Institute (professional development for teachers). FY13 updates are detailed below:

Earth Camp is available to Title I (low socio-economic) schools in the AISD. Students spend one school day at camp immersed in Wildflower Cave looking for clues that water travels through the cave into the Edwards Aquifer, which includes the discovery of cave biota and interactions with professional hydrogeologists. Students also investigate a sinkhole and visit Barton Springs and Splash! Exhibit to learn of the connection of the recharge zone to the discharge area. In FY13, Earth Camp guided 1,572 students into Wildflower Cave. In addition, 5,397 fifth-graders in AISD and Eanes received Earth School, a hands-on classroom presentation using an Aquifer Model. The BS/EACD and Lady Bird Johnson Wildflower Center are partnered with Earth Camp. More details on these programs can be found online at: www.austintexas.gov/EarthCamp and www.austintexas.gov/departments/earth-school. The Ladybird Wildflower Center in partnership with COA WPD also offered a family cave adventure at Wildflower Cave in March 2013 for 15 participants.

In summer 2013, **Parent/Child Clean Creek Camp** brought 53 children and parents into Wildflower Cave and Whirlpool Cave. Clean Creek Camp is a partnership between the COA WPD and Keep Austin Beautiful. Activities focus on watersheds, the Edwards Aquifer and citizen actions that improve water quality. Clean Creek Camp is offered in summer to parents and their children ages 9-14. (www.austintexas.gov/departments/clean-creek-camp)

Hydrofiles reaches aquatic science and environmental science high school classes with a hands-on inquiry based investigation of Austin's water resources. Local field studies involve monitoring local creeks and caving into the Edwards Aquifer. Students learn about hydrogeology and cave biology through "Austin Underground" videos and cave tours led by COA WPD staff. In FY13, approximately 30 high school students were guided through Whirlpool Cave. (www.austintexas.gov/departments/hydrofiles)

Austin Underground: Because of the difficulty of offering a high school cave immersion experience, a virtual field trip using video of the Geology, Hydrogeology, Barton Springs Salamander and Threats/Solutions of the Edwards Aquifer is offered. Each video has a lesson extending the learning about each topic covered (www.austintexas.gov/departments/groundwater-awareness).

FY 13 Adult and Technical Education

Cave skills trainings were provided by COA WPD staff in Whirlpool, Maple Run, Goat Cave, and District Park caves for camp councilors of the Austin Nature and Science Center and COA PARD rangers. The training included cave ecosystems, surface and subsurface exchange of nutrients and water, groundwater hydrogeology, cave safety, vertical descending and ascending technique, and physical challenges in these specific caves. These trained tour leaders provide education for a large number of summer camp children and assist in stewardship of the BCP caves.

In FY13, Nico Hauwert of COA and Brian Cowan of Zara Environmental, LLC presented on the methodology and application of delineating subsurface catchment areas for caves on February 21, 2013 for the USFWS Karst Conservation Initiative (held at Wild Basin), April 4, 2013 for USFWS staff, and May 9, 2013 at the 13th annual sinkhole conference in Carlsbad New Mexico. The published papers can be downloaded from: <http://www.karstportal.org/node/11735?destination=node/11735>

TC/COA BCP staff gave a presentation on monitoring and protection efforts of BCCP caves on February 21, 2013 for the USFWS Karst Conservation Initiative, and for members of the BCP Scientific Advisory Committee and the general public on April 29, 2013.

Groundwater to the Gulf: Summer Institute Groundwater to the Gulf is a collaboration among over a dozen local agencies to offer a 3-day, field-trip based institute for Central Texas teachers that emphasizes techniques for teaching water-based curricula to students in grades 4 through 8. COA WPD educators take teachers inside Wildflower Cave and give presentations at a sinkhole at the Lady Bird Johnson Wildflower Center and Barton Springs so teachers have the background knowledge to teach about the Edwards Aquifer in their classrooms. During the 2013 Institute, 33 teachers were reached. (www.keeptaustinbeautiful.org/GroundwatertoGulf)

Annual BCCP Infrastructure Workshop

COA, LCRA, and TC organized the annual BCP Infrastructure workshop on October 18, 2012. This workshop is primarily intended to help project managers and field supervisors involved in infrastructure projects avoid impacts to the BCP. COA WPD staff presented on procedures for infrastructure near BCP caves and how projects can impact cave ecosystems, and how these impacts can be avoided. The proposed Davis lane realignment project was used as a recent example of how impacts can be avoided through hydrogeological studies. COA and TC BCP staff provided a field trip and presented on karst environments, biology, and impacts to karst ecosystems.

Austin Parks and Recreation

Austin Nature and Science Center (ANSC) offers summer camps and other programs year-round that educate children ages 3-16 on bats, reptiles, salamanders and other wildlife. The Nature Center offers cave tours through their camps as well as for families on special events. In FY13, ANSC took about 585 participants on educational caving trips. The Splash Exhibit in Zilker Park includes a simulated cave and indoor displays, movies, and activities regarding the Edwards Aquifer (<http://www.austintexas.gov/department/austin-nature-science-center>).

Also in FY13, COA PARD rangers initiated a cave education program focusing on adults and families utilizing Maple Run Cave, District Park Cave, and Goat Cave, and led 199 participants on cave tours.

Texas Cave Management Association

In FY13, 1,152 individuals participated in trips through Whirlpool Cave and 30 individuals accessed Lost Oasis Cave. These groups included school field trips and camps (such as Austin

Nature and Science Center camps, Austin Community College and the Girls School of Austin, Not Your Ordinary School), ExploreAustin, scout groups, Austin Fire Dept. rescue practice, and recreational cave groups.

Annual Cave Day Festival

Typically the BS/EACD and TCMA have organized an Annual Cave Day at Village of Western Oaks Karst preserve, drawing an estimated 1,000 attendants; however, there was no Cave Day during FY 13. Until the Village of Western Oaks karst preserve is transferred to the City of Austin, the caves cannot be adequately protected for cave tours. Also the developer and neighborhood bear an unfair liability should an incident occur during cave tours. Therefore it is hoped that the annual Cave Day Festival will be scheduled in 2014, after completion of the real estate transfer. More information on the 2011 Cave Day Festival is shown at:

<http://www.bseacd.org/events/austin-cave-festival/>

5.0 MANAGEMENT COORDINATION AND OVERSIGHT

COA and TC determined that there was a need to create a master database on BCP karst faunal monitoring and management with the ability to analyze these data to determine current status and compliance with the regional permit, as well as determine future needs of the listed species. In 2009, Rob Clayton with WPD developed the Karst Database that houses all faunal survey data from BCCP caves and provides much of the information needed for these karst analyses. This database is now available for use by BCP partners to enter survey data, and all available data have been entered to date. Though the intent is for this database to be a “shared” information source for all the BCP partners, there are still confidentiality challenges on how to establish this protocol. This database will focus on permit compliance, species status, and contribution to recovery.

Based on recommendations made in Dr. Weckerly’s analyses of karst survey efforts on the BCP (Weckerly 2010), COA and TC have determined a need to modify and expand the BCP’s cave monitoring program. In FY11, COA and TC identified 25 caves within Travis County managed through BCP partners that provide a more evenly distributed dataset across cave clusters and karst fauna regions (KFRs); this dataset includes both BCCP caves and other ES/SOC caves on the BCP. This new monitoring plan commenced in FY11, and the number and frequency of karst faunal surveys and cave cricket counts are now synchronized among managing partners to better accommodate comparisons and determine species trends. The goal of these changes to the cave monitoring program is to provide a clearer understanding of the species distribution and health of karst ecosystems across the BCP.

6.0 BIOLOGICAL MONITORING

Caves containing endangered and rare karst invertebrates on BCP properties are monitored to determine long term trends in populations of cave organisms and overall cave conditions. All COA- and TC-owned BCP caves with endangered species are surveyed annually. In addition, TC and COA incorporated the newly expanded monitoring plan in FY11, which includes the 25 Travis County caves selected to represent an evenly distributed dataset across cave clusters and KFRs. Caves included in this monitoring plan are surveyed bi-annually, occurring in Spring (May) and Fall (November) or Summer (August) and Winter (mid-January-mid February). Biomonitoring of the caves follow methodology and techniques supported by USFWS to provide results that can be compared between caves throughout the region for better study and analysis (USFWS 2011a).

Beyond USFWS recommendations, survey methodology also follows guidelines described in the *2007 Balcones Canyonlands Preserve Land Management Plan: Tier II-A Chapter IX Karst Species Management*. The protocol for research and monitoring cave fauna involves the use of one to four (depending on size of cave and logistics) predesignated, permanent survey zones per cave in which all living organisms encountered are identified and enumerated. Survey zones are either transects approximately 5 meters in length that span the width of the cave, or distinct units of the cave such as a small room or an easily discernible section, so that the size and location of the survey area remains constant during the course of the study for trend comparison. For each survey zone, start and end time and the presence of trash or new vandalism are recorded. Relative humidity, temperature, nutrient input, dampness condition, and the presence of red-imported fire ants (RIFA) and tawny crazy ants are also recorded both outside the cave and at each transect or zone. All data collected during cave surveys are entered into the BCP Karst Database.

Any unknown invertebrates observed during faunal surveys are collected and identified by a karst invertebrate specialist. In caves containing endangered species, collecting only occurs with a special collecting permit obtained by USFWS. All collected specimens are deposited within the Texas Memorial Museum or other reputable facility (USFWS 2011a). The date of deposition and collection number is also recorded (USFWS 2011a).

Land managers also monitor the entrances of caves containing endangered species at least once a year for anything that might harm the rare invertebrates including presence of toxic substances, unauthorized access by recreational cavers, and surface disturbances which might have erosive potential or cause changes in surface drainage patterns.

The overall health of caves is also monitored by performing semi-annual cave cricket exit counts. Cave cricket exit counts are done as crickets emerge from caves during good weather nights (i.e. not raining, warm etc.). The duration of the counts is timed for 2 hours starting just after sunset, to maintain consistency with all surveys done between managing partners. Current weather conditions, surface temperature, and relative humidity are documented for each survey. Crickets emerging are placed in one of three age classes: nymph (up to 5 mm), sub-adult/juvenile (5-12mm) and adult (>12mm). Number of individuals exiting the cave is counted in ten-minute intervals. Time of first cave cricket exit and any other vertebrates exiting the cave are also recorded.

FY13 TC/COA Collaborative Monitoring Projects

In FY 13, USFWS contracted with Marshal Hedin at San Diego State University in an effort to confirm the species of blind Cicurina found in Pickle Pit Cave, which is known as the type locality for *Cicurina wartoni*, a candidate species for listing under the ESA. In 2009, Paquin and Duperre redescribed *C. wartoni* and provided morphological and geographical evidence to suggest that this taxon is a member of the *C. buwata* species complex (including *C. wartoni*, *C. reddelli*, *C. buwata*, and *C. trivisiae*). Therefore, there was a need to verify the validity of this taxon. COA and Travis County BCP staff collaborated on this project by providing Cicurina specimens collected from all of the type localities listed for northern Travis County, including Pickle Pit Cave. TC and COA BCP staff also conducted a full cave faunal survey at Pickle Pit Cave in Spring of 2013 (EXHIBITA).

In FY12, TC and COA BCP staff collaborated on a monitoring and collection protocol and reporting procedures for the tawny crazy ant (*Nylanderia fulva*), a newly discovered non-native species which could potentially adversely affect forest and karst ecosystems on the BCP. Since FY12, BCP staff have included monitoring for presence of the tawny crazy ant at all visits to cave sites. In FY13, at least one BCCP cave (Whirlpool Cave) has been confirmed to be infested by the tawny crazy ant, which was observed > 100 ft from the cave's entrance. COA and TC staff have begun conducting quarterly biological surveys at Whirlpool Cave in FY13 to document tawny crazy ant use of cave environments and assess impacts of this new invasive species on cave fauna (EXHIBITA). Beginning in FY14, TC and COA will also expand monitoring of Weldon and No Rent Caves to document the arrival and impacts of another tawny crazy ant population <200 m from these caves. In addition, COA and TC BCP staff are collaborating with local tawny crazy ant specialist Ed LeBrun of UT's Brackenridge Field Lab to study impacts to karst invertebrate assemblages and design control methods for use within sensitive karst environments.

Also in FY13, for the first time since the 1960s, TC staff were able to obtain permission to access Spanish Wells Cave, and confirmed this BCCP cave's locality for further acquisition/protection efforts. In addition, TC/COA staff performed a cave faunal survey in Spanish Wells Cave, re-confirming presence of *Sphalloplana* flatworms, the BCCP SOC known for this locality (EXHIBIT A). Cave mapping and hydrogeologic data were also collected for determining catchment areas (See section 7.0 for details).

TC and COA BCP staff began conducting bi-annual cave faunal surveys of Millipede Cave and Millipede Annex Cave in FY13 to gather baseline data for the McNeil High School courtyard restoration project, scheduled to commence in FY14 (EXHIBIT A). Vegetation planting and management activities such as RIFA control are being coordinated with McNeil High School staff and students to improve surface conditions of these two non-BCCP ES caves, with the intent of improving nutrient input and benefiting cave crickets and cave fauna.

City of Austin FY13 Biological Monitoring

During FY13, COA BCP staff conducted bi-annual monitoring on the following 15 pre-selected caves: Airmen's Cave, Broken Arrow Cave, Cave Y, Cortana Cave (non-BCCP cave), Cotterell Cave, District Park Cave, Flintridge Cave, Jester Estates Cave, Little Bee Creek Cave, Maple Run Cave, Midnight Cave, Pond Party Pit (non-BCCP cave), Seibert Sink (non-BCCP cave), Spider Cave, and Stovepipe Cave (EXHIBIT A). Faunal surveys in these caves were conducted by permitted COA biologists in either Fall 2012/ Spring 2013 or Winter 2013/ Summer 2013. Annual faunal surveys were also conducted in Arrow Cave, Beard Ranch Cave, Blowing Sink, Goat Cave, Rolling Rock Cave, and Slaughter Creek Cave (EXHIBIT A).

In FY13, COA with the help of volunteers conducted bi-annual cave cricket exit counts at the same 15 caves pre-selected for faunal surveys, with the addition of Testudo Tube (EXHIBIT B). COA staff also conducted one cave cricket exit count at Jest John cave. (EXHIBIT B).

In FY13, COA BCP staff assisted COA WPD staff in monitoring recently uncovered voids at the Apple/ Riata pond construction site. BCP staff collected one adult blind *Cicurina* spider and then worked with ACI consultants on follow-up inspections following USFWS protocol (USFWS 2011a). One major problem was how to close off voids between surveys to maintain the pre-existing cave climate. Several methods were deployed in an effort to properly close these voids, some of which were successful. COA WPD and BCP staff met with USFWS staff on January 17, 2013 in an effort to address existing problems with the current requirements on how to properly secure voids (USFWS 2011a). The primary issue discussed was what type of material

should be used and how best to secure it, thus effectively sealing the feature without the introduction of toxic chemicals to the site. This effort will better protect features that are discovered during construction.

Travis County FY13 Biological Monitoring

TC's BCP staff conducted bi-annual monitoring on the following nine pre-selected caves: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave (non-BCCP cave), McDonald Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Faunal surveys in these nine caves, with permitted TC biologists, were conducted in either Fall 2012/ Spring 2013 or Winter 2013/ Summer 2013 (EXHIBIT A). Annual faunal surveys were also conducted in six other TC-owned BCCP caves with federally listed species: Kretschmarr Cave, Kretschmarr Double Pit Cave, New Comanche Trail Cave, North Root Cave, Root Cave, and Tardus Hole (EXHIBIT A). TC staff also conducted annual faunal surveys at two additional BCCP listed caves: Ireland's Cave and Talus Springs Cave, and two additional TC-owned BCP caves with listed ES: Two Trunks Cave and Tight Pit Cave (EXHIBIT A).

In FY13, TC conducted bi-annual cave cricket exit counts at the same nine caves pre-selected for faunal surveys: Adobe Springs Cave, Amber Cave, Cold Cave, Gallifer Cave, Geode Cave, McDonald Cave, Stark's North Mine, Tooth Cave, and Weldon Cave. Exit counts were conducted in either Fall 2012/ Spring 2013 or Winter 2013/ Summer 2013 (EXHIBIT B).

Red-imported fire ant (RIFA) surveys were performed in Fall 2012 and Spring 2013 on all eleven TC-owned BCCP caves with federally listed species, as well as all other TC-owned caves with ES (Geode Cave, Tight Pit Cave, and Two Trunks Cave). RIFA surveys were also conducted at two additional TC-owned BCCP caves (Ireland's Cave and Talus Spring Cave). RIFA mounds were surveyed within a 80 m radius around cave entrances, and all mounds found during surveys were treated with boiling water as recommended by USFWS (2011b). Of note in FY13 was a major increase in RIFA activity in the cave survey areas, probably due to the break in the intense heat wave and persistent drought which occurred in previous years. In Fall of 2012, a total of 180 RIFA mounds were treated within these 80 m cave survey areas, with an additional 40 RIFA mounds treated in the vicinity of caves but outside of survey areas. In Spring of FY13, a total of 193 RIFA mounds were treated within these 80 m cave survey areas, with an additional 25 RIFA mounds treated in the vicinity of caves but outside of survey areas. Survey results and treatments for individual caves are documented in Table 4.

In addition to managing the karst features required in the BCCP permit, TC voluntarily managed other karst features located on BCP land in FY13, including Cactus Pit, Brew Pot Cave, Kretschmarr Sink, Kretschmarr Salamander Cave and karst features RI-1, LU-11 and LU-12. Site assessments and explorations were also conducted at a karst feature on the newly acquired Webb Tract. Also in FY13, TC staff photographed, tree tagged and verified locations for eight Travis County BCP karst features following standardized methods for improving protection efforts.

7.0 HYDROGEOLOGIC STUDIES

The understanding and protection of water sources to caves is vital for preserving cave life that relies on it. Water sources include surface catchment areas that direct runoff to the cave entrance and subsurface catchment areas where overlying water infiltration from either rainfall or runoff supports cave drips. Surface catchment area delineation generally involves examination of a combination of field GPS delineation of catchment divides and drainages as well as surface topographic contour coverages. Subsurface catchment studies may involve direct tracing, water-quality characterization, drip rate monitoring, geological mapping, cave survey mapping, and cave radio surveying. In FY13, a BCP access permit was provided to Brian Cowan and other staff from Zara Environmental LLC, Nico Hauwert of COA WPD, and Roger Glick of COA WPD.

Flint Ridge Cave

Flow monitoring of runoff into Flint Ridge Cave continued in 2013 by Roger Glick and his hydrological monitoring team. In FY14, COA WPD staff plan on utilizing new LIDAR surface topography coverages and GPS field survey of debris lines to re-examine the surface catchment area for Flint Ridge Cave along its western edge.

Goat Cave, Maple Run, and Blowing Sink Hydrogeological Study

A hydrogeological study of water source areas for Goat Cave, Maple Run, and Blowing Sink caves is being conducted by Nico Hauwert with Brian Cowan and other staff of Zara Environmental. The participation of Zara Environmental, which involves intensive monitoring of cave drips and faunal surveys, is funded by COA Public Works through a Davis Lane realignment project managed by George Jackson, P.E. The preliminary findings and steps being taken by the COA to preserve the cave drips is included in a report entitled “Summary of Initial Hydrogeologic Study Results, Evaluation of Impacts from Davis Lane, and Proposed Solutions to Protect Water Sources to Goat, Maple Run, and Blowing Sink Balcones Canyonlands Preserve

Caves” (Hauwert 2012). The preliminary results found that perched groundwater south of Goat Cave is directed 3,000 feet south toward Blowing Sink Cave. Goat Cave and Maple Run Caves would not normally derive roadway runoff from Davis Lane except through a stormwater drainage to an unlined Maple Run Section 8 water-quality pond constructed in 1985.

In January 7- 8, 2013 tracers were injected in the west drainage, in the Maple Run Section 8 water-quality pond, and within Wade Sink all within or adjacent to the Goat Cave karst preserve. While some tracers were detected, the trace was overall problematic in that there were insufficient rains to flush the tracer. Follow-up tracing was conducted on September 20, 2013 in Maple Run Section 8 pond that included observing flows within the cave. Final proposed trace and completion of the hydrogeologic report is expected in FY14.

Spanish Wells Cave

For the first time since the adoption of the BCCP, TC received permission to access Spanish Wells Cave in FY13. Nico Hauwert mapped the cave during a visit on May 28, 2013 and delineated the surface and subsurface catchment areas. The subsurface catchment area is preliminary in nature, based on mapped cave elevations projected on surface topography.

Stark’s North Mine

In FY13, Stark’s North Mine was mapped by COA WPD staff with help from TC BCP staff. Survey monuments were installed outside the mine that were professionally surveyed by McGray & McGray Surveyors. A basic hydrogeological study is being prepared to be completed in FY14 that compares surveyed mine elevations with surface elevations. A cave cricket foraging study by Zara Environmental, LLC is also planned for FY14, in association with plans to extend COA PARD’s Walnut Creek Trail in the vicinity of Stark’s North Mine.

District Park Cave

Little useful drip monitoring data was acquired in FY13 as both Aquifer Room and Aggie Room gauges did not appear to be placed under drips. Temperature data was collected from the Aggie Room, suggesting a 3 degree Fahrenheit annual cycle temperature fluctuation. Rain events on Oct 12 and Oct 31, 2013 and backwater behind a downstream flood control dam caused the cave to be inundated. The lower Aggie Room appeared to have been filled to the ceiling with floodwater. COA WPD plans to re-excavate the entry crawl in FY14 to regain access.

8.0 RECOMMENDATIONS

COA and TC should continue to attempt to contact the owners of each privately-owned BCCP cave in order to assess current faunal assemblages and negotiate protection of these caves. The precise location of some of these privately owned caves is currently unknown; therefore, the COA and TC should attempt to locate these caves in order to make a meaningful assessment. Additionally, there may be a need to substitute some of the privately owned caves listed on the BCCP permit that are unable to be located or protected. During FY14, COA and TC will continue evaluating the adequacy of protection for all of the 62 BCCP caves. If protection is not possible for one or more BCCP caves, USFWS will be consulted to evaluate whether any caves could potentially serve as a replacement.

Future research needs for the BCP should include an effort to determine to species level for currently unknown troglobites such as *Speodesmus* sp., *Eidmannella* sp., and Trichoniscidae found in BCP caves.

9.0 KARST MANAGEMENT ACTIVITIES

The BCP Karst Land Management Plan (2007) outlines planned activities concerning the 62 BCCP karst features. Table 4 below includes a summary of monitoring and management activities for these features completed in FY13.

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.	
<u>Adobe Springs Cave</u> The Nature Conservancy	<ol style="list-style-type: none">1. TC was granted continued permission from TNC to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program.2. TC performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.3. TC/COA conducted bi-annual cave faunal surveys (see EXHIBIT A).4. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
<u>Airmen's Cave</u> City of Austin	<ol style="list-style-type: none">1. Conducted bi-annual cave faunal surveys (See EXHIBIT A).2. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B)3. COA installed a cave gate within 18 feet of the entrance of the cave. The cave gate not only protects the cave from ongoing vandalism, but also serves to protect the public from future accidents involving un-trained access. Access is still allowed via permit and the COA and volunteers host an "open house day" once a month allowing the public access to the cave.4. Volunteers monitor the cave gate twice weekly, and have helped COA staff make cave gate and sign repairs.
<u>Amber Cave</u> Travis County	<ol style="list-style-type: none">1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.2. Maintained fencing and signage to protect this area from unauthorized access and dumping.3. Surveyed site bi-annually for RIFA. Treated 15 mounds in Fall 2012 and 12 mounds in Spring 2013.4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
<u>Armadillo Ranch Sink</u> Private	
<u>Arrow Cave</u> City of Austin	<ol style="list-style-type: none">1. Completed annual cave faunal survey (See EXHIBIT A).2. Conducted quarterly site inspections. City staff continues to deal with ongoing dumping problems from the adjacent neighborhood. COA BCP staff met on site with COA Park Rangers in an effort to address these ongoing problems.3. Inspected site for RIFA infestations. On all visits RIFA were observed within close proximity of the cave (but not inside the cave).
<u>Bandit Cave</u> Private	

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

<u>Beard Ranch Cave (Featherman's Cave)</u> City of Austin 1. Completed annual cave faunal survey (See EXHIBIT A). 2. Conducted quarterly site inspections. 3. No RIFA were found. A healthy population of native fire ants was found in close proximity to the cave.
<u>Bee Creek Cave</u> <u>Private</u>
<u>Blowing Sink Cave</u> City of Austin 1. Inspected semi-monthly, installed security cameras, repaired perimeter fence, added "no trespass" signs, and met with COA PARD Rangers and WPD staff in an effort to increase on site patrols. 2. Treated site for RIFA with boiling water. 3. Completed cave faunal survey (See EXHIBIT A). 4. Continued work on an in-depth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane. 5. Met with PARD and WPD staff regarding land currently owned by AISD that will be deeded to PARD. The 26 acre parcel is immediately south of Blowing Sink Cave, and includes a new cave and well. When the property is transferred, COA will request that the current owner install a 6' chain link fence with 3 strands of barbed wire along the perimeter of the property, thus greatly improving security to the property. 6. COA staff removed invasive non-native vegetation from the preserve. 7. WPD staff initiated efforts to stabilize and secure several sinkholes located on the tract. Currently these features contribute large amounts of sediment into the aquifer and are also a potential safety liability. WPD staff met on site with a WPD Engineer to determine the best method to accomplish this goal. 8. Staff discovered illegal clearing work by Phillips 66; worked with PARD staff to determine mitigation measures for reimbursement of illegal cut trees. 9. Staff discovered encroachment issues from several homeowners along the western boundary of the preserve; PARD staff are negotiating with homeowners on appropriate mitigation measures.
<u>Broken Arrow Cave</u> City of Austin 1. Inspected quarterly with no sign of human visitation or vandalism. 2. Treated site for RIFA with boiling water. 3. Completed bi-annual faunal surveys (See EXHIBIT A). 4. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).
<u>Buda Boulder Spring</u> City of Austin 1. Visited the site twice and noted no new negative impacts to the spring. 2. Searched for aquatic invertebrates in the spring, no SOC were observed.
<u>Cave X</u> Private 1. COA entered into a Private Landowner Agreement "Cave X, Management and Monitoring Plan, Covenants and Restrictions", with the property owners (Regent's School) in Oct. 1999. The agreement sets aside a 4.5 acre area to protect the cave footprint. USFWS was involved in the discussions on protection. 2. Cave entrance is gated and also has a fence for added protection. 3. Regents staff conduct periodic surface inspections of the cave including gate and lock maintenance. 4. WPD negotiated with the property owner to increase biological monitoring (bi-annual cave faunal and cave cricket exit count surveys) and management of the cave as part of an agreement for a variance for on-site construction of a berm to reduce the area currently listed as within the 100 year flood plain. Regents hired SWCA to do the above mentioned work, but to date, SWCA has conducted only cave cricket exit counts, in violation of the agreement. COA WPD and BCP staff are continuing to try to work with the applicant to fulfil their agreement.

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

<u>Cave Y</u> City of Austin 1. Visited this cave 6 times and noticed no signs of vandalism to the cave or cave gate. 2. Treated site for RIFA with boiling water. 3. Completed bi-annual cave faunal survey(See EXHIBIT A). 4. Completed bi-annual cave cricket exit counts. (See EXHIBIT B).
<u>Ceiling Slot Cave</u> Private
<u>Cold Cave</u> 1. TC is negotiating with the landowners concerning the possibility of purchase, conservation easement, or a management agreement for this 8 acre tract. 2. TC gained continued permission from landowner to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program. 3. TC performed surface inspections with no signs of vandalism to the cave entrance or in the cave. 4. TC conducted bi-annual cave faunal surveys (see EXHIBIT A). 5. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
<u>Cotterell Cave</u> City of Austin 1. Conducted quarterly site inspections. 2. RIFA were treated once with boiling water; most of the ants were located at the parking lot, approximately 300 feet from the cave. 3. Conducted bi-annual cave faunal surveys (see EXHIBIT A). 4. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).
<u>Disbelievers Cave</u> Private 10a Permit: PRT-808694 1. WPD mapped relocated features on site and mapped new CEF's to see how close they are to the new proposed development to make certain that the applicant is in compliance with City code.
<u>District Park Cave</u> City of Austin 1. BCP staff conducted bi-annual cave faunal surveys (See EXHIBIT A). 2. BCP staff and volunteers conducted bi-annual cave cricket exit counts (See EXHIBIT B). 3. Conducted site surveys quarterly, other than trash at the entrance no new major problems noted.. 4. Permitted access to this cave was allowed. 5. BCP staff removed trash from the un-gated portion of the cave. 6. Treated site for RIFA with boiling water. 7. COA WPD Hydrogeologist continued to work on a hydrological study to determine the sub-surface drainage and to see if the adjacent developed area of the park could negatively impact the cave. 8. COA BCP staff initiated meetings with PARD staff to iron out a cave management agreement, which will provide future protection for this and other karst features located on the property.
<u>Eluvial Cave</u> Private 10a Permit: PRT-808694 1. WPD mapped relocated features on site and mapped new CEF's to see how close they are to the new proposed development to make certain that the applicant is in compliance with City code.

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

Flint Ridge Cave

City of Austin

1. Conducted 6 site visits and noted no signs of illegal trespass.
2. Treated site for RIFA with boiling water; staff treated numerous active mounds due to favorable habitat (open and disturbed).
3. Conducted bi-annual cave faunal surveys (See EXHIBIT A).
4. BCP staff and volunteers conducted bi-annual cave cricket exit counts (See EXHIBIT B).
5. COA WPD continued to monitoring the storm water catchment area of Flint Ridge cave.
6. COA WPD and BCP staff reviewed TXDOT proposal to build SH45 that is proposed to be built over the surface catchment area as well as the cave footprint.

Fossil Cave

City of Austin

1. Inspected quarterly and found no new signs of vandalism
2. Inspected for RIFA infestations on all visits. RIFA were observed within close proximity of the “suspected” cave
3. COA BCP staff initiated meetings with PARD staff to iron out a cave management agreement, which will provide future protection for this and other karst features located on the property.

Fossil Garden Cave

Private

Gallifer Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.
2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Surveyed site bi-annually for RIFA. Treated 26 mounds in Fall 2012 and 33 mounds in Spring 2013.
4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).
5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).

Get Down Cave

TCMA

1. COA WPD is currently in negotiations with the neighborhood association to take over ownership and management of this cave and property (includes several other significant karst features).
2. Commented on COA WPD proposal to experiment with different non-toxic ways to eradicate unwanted weeds on the hiking trail.

Goat Cave

City of Austin

1. Completed annual faunal survey (See EXHIBIT A).
2. Treated RIFA annually with boiling water.
3. With the help of volunteer stewards, conducted twice monthly site inspections, removed trash from preserve area and reported on anything out of the ordinary.
4. Allowed permitted access to this cave .
5. Continued to periodically repair the perimeter fence cuts and tagged signs by vandals, many of these incidents were reported by our volunteer land steward and in some cases the volunteer made the needed repairs.
6. COA WPD staff continued work on an in-depth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane.

Hole-in-the-Road Cave

Private

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

<u>Ireland's Cave</u> Travis County 1. TC acquired the 4.8 acre tract containing the cave from Muirfield Homeowner Association and began full management of the cave and surrounding property in FY12. 2. Performed periodic surface inspections and noted recent signs of vandalism and trespass inside the cave. 3. TC contracted Bat Conservation International to install a bat friendly cave gate in March 2013. 4. Surveyed site bi-annually for RIFA. Treated 24 mounds in Fall 2012. 5. TC conducted an annual cave faunal survey (see EXHIBIT A).
<u>Jack's Joint Cave</u> Private
<u>Japygid Cave</u> Private 10a Permit: PRT-808694 1. WPD mapped relocated features on site and mapped new CEFs to ensure that proposed new development is in compliance with City code.
<u>Jest John Cave</u> City of Austin 1. Conducted 2 site visits found and no signs of vandalism or human visitation. 2. Inspected site for RIFA infestations, no RIFA were observed near the cave. 3. Conducted one cave cricket exist count. (See EXHIBIT B).
<u>Jester Estates Cave</u> City of Austin 1. BCP staff conducted 6 site visits looking for signs of illegally discharged pools, dumped brush and trash from neighbors. It appears that past educational efforts have paid off, no illegal activities were observed. 2. WPD staff and a volunteer continued work on an hydrological study of this cave which included: remapping the cave interior, determining the surface drainage, and taking water samples in an effort to determine if the cave is being negatively impacted by adjacent development. It appears that the cave subsurface drainage area is much larger than the 3.2 acre preserve. 3. Treated site twice for RIFA with boiling water. 4. Conducted bi-annual cave faunal surveys (See EXHIBIT A). 5. Conducted bi-annual cave cricket exit counts. (SEE EXHIBIT B). 6. BCP staff removed non-native invasive vegetation.
<u>Jollyville Plateau Cave</u> Private 10a Permit: PRT-808694 1. WPD mapped relocated features on site and mapped new CEFs to ensure that proposed new development is in compliance with City code.
<u>Kretschmarr Cave</u> Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Conducted a trash clean-up around the cave site and surrounding area. 3. Maintained fencing and signage to protect this area from unauthorized access and dumping. 4. Surveyed site bi-annually for RIFA. Treated 29 mounds in Fall 2012 and 83 mounds in Spring 2013. 5. Conducted annual cave faunal survey (see EXHIBIT A).
<u>Kretschmarr Double Pit</u> Travis County 1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave. 2. Maintained fencing and signage to protect this area from unauthorized access and dumping.

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

3. Surveyed site bi-annually for RIFA. Treated 6 mounds in Fall 2012 and 24 mounds in Spring 2013.
4. Conducted annual cave faunal survey (see EXHIBIT A).

Lamm Cave

Section 7 Permit 2-15-93-F-075

(see USFWS files)

1. The City of Austin negotiated protective measures for this cave including a Land Management Plan for this cave. The cave has a setback size of approximately 4.13 acres. The radius of the setback varies from a minimum of 123 feet south of the cave to a maximum of 340 feet north of the cave.
2. The cave was gated and the preserve area was fenced following COA WPD and BCP staff recommendations and design.
3. No application of fertilizers, pesticides or herbicides will be allowed in the CEF area.

Little Bee Creek Cave

City of Austin

1. Conducted two site visits.
2. Conducted bi-annual cave faunal survey (See EXHIBIT A).
3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).

Lost Oasis Cave

TCMA

Lost Gold Cave

Private

Maple Run Cave

City of Austin

1. Conducted bi-annual cave faunal survey (See EXHIBIT A).
2. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).
3. With the help of volunteer stewards: conducted weekly site inspections, removed trash from preserve area and reported on anything out of the ordinary.
4. Permitted access to this cave is allowed.
5. Treated site for RIFA with boiling water.
6. COA WPD staff continued work on an in-depth hydrological study to determine the potential impacts of a new road extension and realignment of Davis Lane.
7. COA WPD staff also looked at potentially retrofitting the existing storm water/ filtration pond located directly over the footprint of the cave. In an effort to determine the precise location of the cave in relationship to the existing storm water pond, COA WPD staff used a cave radio to verify the location.

McDonald Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.
2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Surveyed site bi-annually for RIFA.
4. Conducted bi-annual cave faunal surveys (see EXHIBIT A).
5. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).

McNeil Bat Cave

Private

Midnight Cave

City of Austin

1. Conducted quarterly site inspections (observed fence and sign vandalism, made repairs and met on site with

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

COA PARD Rangers in an effort to increase on site patrols..
2. Conducted bi-annual cave faunal surveys. (See EXHIBIT A).
3. Treated site for RIFA with boiling water and trained COA PARD staff on RIFA treatment methods.
4. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).
5. Volunteers initiated a new detailed survey map of the cave (on going).
6. Permitted access to this cave is allowed, though no access permits were granted this fiscal year.
7. Witnessed nearby pesticide application, by Lone Star Soccer Assoc. staff, continued to work with PARD staff to determine how to protect the cave from pesticides and fertilizers and still accommodate the needs for park users. PARD staff have agreed to restrict pesticide use within the cave cricket foraging area.

M.W.A. Cave

Private 10a Permit: PRT-808694

(see FWS files for status)

1. WPD mapped relocated features on site and mapped new CEFs to ensure that proposed new development is in compliance with City code.

Moss Pit Cave

Private

New Comanche Trail Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.
2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Surveyed site bi-annually for RIFA.
4. Conducted annual cave faunal survey (see EXHIBIT A).

No Rent Cave

Private

1. TC/COA conducted a surface inspection for presence of tawny crazy ants; none detected.
2. TC/COA performed a faunal survey (see EXHIBIT A).

North Root Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.
2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Surveyed site bi-annually for RIFA. Treated 11 mounds in Fall 2012.
4. Conducted annual cave faunal survey (see EXHIBIT A).

Pennie's Cave

Private

1 The entrance has been GPS located and dug-out to a depth of about five feet in 2008.
2. A new development plan is seeking approval for the site containing the cave.
3.The site plan calls for the cave entrance to be gated and boulders placed around the cave at the edge of a 300-ft buffer.
4.Additional excavation is needed to completely uncover the entrance and open the passage into cave; WPD is working with the land owner to protect the cave and re-establish the cave habitat.
5. The proposed Commercial Development has not started construction. The developer filed for an extension to their development permit November 2010 and construction on a turn lane into the start should be permitted within 180 days. Once construction activities start on Commercial Development, the cave entrance will be gated.

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

Pickle Pit Cave

Section 7 Permit 2-15-93-F-075

1. Staff from Loomis, USFWS, and COA BCP and COA WPD staff met on site and conducted one cave faunal survey (collected blind *Cicurina* to help with future species identification. (See EXHIBIT A).
2. USFWS contracted with Marshal Hedin to verify the validity of the species *Cicurina wartoni*, which has been petitioned to be listed.

Pipeline Cave

Private

1. A 2004 agreement between COA and Stratus set aside a fenced buffer around Pipeline cave that varies from 100 feet to the east and up to 300 feet west of the cave and an additional setback of 300 feet to the north and west; 150 ft to east and south for the adjacent feature known as Confusion Sink.
2. Developer installed cave gate (including a gate on the nearby “confusion cave”, silt fences were in place but no permanent fences delineating the preserve area was in place. COA BCP staff reported findings to WPD staff.

Rolling Rock Cave

City of Austin

1. Inspected quarterly and no sign of human visitation or vandalism was found.
2. RIFA control.
3. Conducted one cave faunal survey. (See EXHIBIT A).

Root Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.
2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Surveyed site bi-annually for RIFA. Treated 11 mounds in Fall 2012.
4. Conducted annual cave faunal survey (see EXHIBIT A).

Slaughter Creek Cave

City of Austin

1. Conducted quarterly site inspections, observed signs of attempted vandalism (digging tools, fire, and trash), met on site with COA PARD Rangers in an effort to increase onsite patrols..
2. Conducted one cave faunal survey. (See EXHIBIT A)

Spanish Wells Cave

Private (location unknown)

1. TC/COA verified a precise location of cave using Trimble GPS unit.
2. Collected data to create a cave map and delineate surface and sub-surface catchment areas.
3. TC/COA conducted one cave faunal survey (See EXHIBIT A).

Spider Cave

City of Austin

1. Conducted four site visits, and no sign of human access or vandalism was found.
2. Conducted bi-annual cave faunal surveys (See EXHIBIT A).
3. Conducted bi-annual cave cricket exit counts. (See EXHIBIT B).
4. Treated site for RIFA with boiling water.

Stark's North Mine

Travis County

1. TC acquired this cave and 0.8 acres surrounding it in FY12. The area surrounding the cave is all previously developed.
2. Performed surface inspections and detected signs of vandalism to the cave entrance and inside the cave.
3. TC/COA WPD collected data to create a cave map and delineate surface and sub-surface catchment areas.
4. Surveyed site bi-annually for RIFA. No mounds found within 80 m of cave.

Table 4. FY13 BCCP Karst Feature Monitoring and Management Activities.

5. Conducted bi-annual cave faunal surveys (See EXHIBIT A).
6. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).

Stovepipe Cave

1. Conducted 6 site inspections, and continued to remove old trash from the preserve.
2. Repaired perimeter fence.
3. Conducted bi-annual cave faunal surveys (See EXHIBIT A).
4. Conducted bi-annual cave cricket exit counts (See EXHIBIT B).

Talus Springs Cave

Private

1. The USFWS 10a permit PRT 815447 mitigation requirement intended this cave to go to TC, however, the cave is located on private land just outside of the mitigation area. TC has continued requesting that the homeowners association donate the land to TC; Coordinated management with them.
2. Performed surface inspections with no signs of vandalism to the cave entrance or in the cave.
3. Surveyed site bi-annually for RIFA. Treated 2 mounds in Fall 2012.
4. Conducted annual cave faunal survey (see EXHIBIT A).

Tardus Hole Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.
2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Surveyed site bi-annually for RIFA. Treated 7 mounds in Fall 2012 and 21 mounds in Spring 2013.
4. Conducted annual cave faunal survey (see EXHIBIT A).

Tooth Cave

Travis County

1. Performed periodic surface inspections with no signs of vandalism to the cave entrance or in the cave.
2. Maintained fencing and signage to protect this area from unauthorized access and dumping.
3. Conducted a trash clean-up around the cave site and surrounding area.
4. Surveyed site bi-annually for RIFA. Treated 32 mounds in Fall 2012 and 43 mounds in Spring 2013.
5. Conducted bi-annual cave faunal surveys (see EXHIBIT A).
6. Conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).

Weldon Cave

Private

1. TC gained continued permission from landowner to perform bi-annual faunal surveys and cave cricket exit counts for the expanded BCP Cave Monitoring program.
2. TC performed surface inspections with no current signs of vandalism to the cave entrance or in the cave.
3. TC conducted bi-annual cave faunal surveys (see EXHIBIT A).
4. TC conducted bi-annual cave cricket exit surveys. (See EXHIBIT B).

Whirlpool Cave

TCMA

1. In response to the discovery of the invasive tawny crazy ant inside this cave, TC/COA BCP commenced conducting cave faunal surveys quarterly in an effort to determine what impacts this invasive species will have on cave fauna (see EXHIBIT A).
2. TCMA continued to allow permitted access to the cave; however, in an effort to limit access and to raise funds for cave management, they are now charging a fee for access.

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EXHIBIT A:
KARST FAUNAL SURVEY REPORTS

FY13 City of Austin/Travis County Karst Faunal Surveys^{1,2}

Cave	Survey Date	Monitoring Agency	Endangered Species							Species of Concern										Other Significant Troglobites										Other notable species detected
			<i>Neolepioneta myopica</i>	<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Texanaurops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidolea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina ellioti</i>	<i>Cicurina trivisae</i>	<i>Eidmannella reclusa</i>	<i>Neolepioneta concinna</i>	<i>Neolepioneta devia</i>	<i>Rhadine austinnica</i>	<i>Rhadine subterranea</i>	<i>Speodesmus</i> NS	<i>Cicurina</i> sp. (blind)	<i>Eidmannella rostrata</i>	<i>Eidmannella</i> sp.	<i>Neolepioneta</i> sp.	<i>Speodesmus bicornourus</i>	<i>Speodesmus</i> sp.	<i>Tartarocreagris infernalis</i>	<i>Texoreddellia texensis</i>				
Adobe Springs Cave	11/28/2012	TC																												
Adobe Springs Cave	5/29/2013	TC																												
Airmen's Cave	1/24/2013	COA								7									4	14			1						<i>Tartarocreagris</i> sp. (6) <i>Perimyotis subflavus</i> (4)	
Airmen's Cave	8/12/2013	COA								16						2				57			7							
Amber Cave	11/29/2012	TC										5											35							
Amber Cave	5/30/2013	TC				1						17											7							
Arrow Cave	9/11/2013	COA								16											6									
Beard Ranch Cave	1/16/2013	COA																		1										
Blowing Sink Cave	3/28/2013	COA								4						5							4							
Broken Arrow Cave	11/1/2012	COA							50									9					9						<i>Stygobromus russelli</i> (5)	
Broken Arrow Cave	5/29/2013	COA		2														4					15						<i>Stygobromus russelli</i> (15)	
Cave Y	1/24/2013	COA								11													1						<i>Texella grubbsi</i> (7) <i>Perimyotis subflavus</i> (12)	
Cave Y	8/12/2013	COA								14						1							2						<i>Texella grubbsi</i> (18) <i>Tartarocreagris</i> sp. (1)	
Cold Cave	1/29/2013	TC						6										2					27						<i>Batrisesodes</i> sp. (2) <i>Rhadine</i> sp. (1)	
Cold Cave	8/7/2013	TC						12										14				17	26							
Cortana Cave	1/21/2013	COA	16															1												
Cortana Cave	8/7/2013	COA	27					1					3																	
Cotterell Cave	1/16/2013	COA						7															11	3					<i>Cicurina buwata</i> (58)	
Cotterell Cave	8/6/2013	COA						5										4					29	2					<i>Cicurina buwata</i> (47)	
District Park Cave	11/2/2012	COA								21																				
District Park Cave	5/30/2013	COA								8						1		7											<i>Tayshaneta sandersi</i> (1)	
Flint Ridge Cave	11/2/2012	COA								44										1			46						<i>Texella mulaiki</i> (1)	

			Endangered Species						Species of Concern										Other Significant Trogllobites								Other notable species detected
Cave	Survey Date	Monitoring Agency	<i>Neoleptoneta myopica</i>	<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Texanuraops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina ellioti</i>	<i>Cicurina triviseae</i>	<i>Eidmannella reclusa</i>	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinnica</i>	<i>Rhadine subterranea</i>	<i>Speodesmus NS</i>	<i>Cicurina sp. (blind)</i>	<i>Eidmannella rostrata</i>	<i>Eidmannella sp.</i>	<i>Neoleptoneta sp.</i>	<i>Speodesmus bicornouturus</i>	<i>Speodesmus sp.</i>	<i>Tartarocreagris infernalis</i>	<i>Texoreddellia texensis</i>	
Flint Ridge Cave	5/30/2013	COA								32						6					8			44		1	<i>Texella mulaiki</i> (2)
Gallifer Cave	2/6/2013	TC	3					31			22										1			1			<i>Perimyotis subflavus</i> (3)
Gallifer Cave	8/6/2013	TC	6					23			26												4				
Geode Cave	1/23/2013	TC	7					1					2										1				
Geode Cave	8/12/2013	TC	18	1				6					2						10					8			<i>Batrisesodes sp.</i> (2)
Goat Cave	9/11/2013	COA								8											3	1		7			
Ireland's Cave	2/5/2013	TC								41						15							9				<i>Batrisesodes sp.</i> (2)
Jester Estates Cave	11/1/2012	COA	8		6		13												12								<i>Rhadine sp.</i> (1)
Jester Estates Cave	5/29/2013	COA	13		3		11												7				9				<i>Anapistula sp.</i> (6) <i>Rhadine sp.</i> (1)
Kretschmarr Cave	11/14/2012	TC										11									4		1				
Kretschmarr Double Pit	11/8/2012	TC																	1								<i>Texella sp.</i> (1)
Little Bee Creek Cave	11/30/2012	COA					6														4						
Little Bee Creek Cave	5/30/2013	COA					3			1										1				5			<i>Batrisesodes sp.</i> (1)
Maple Run Cave	1/22/2013	COA								8						2								4			<i>Anapistula sp.</i> (3)
Maple Run Cave	8/9/2013	COA								12														2			<i>Anapistula sp.</i> (8) <i>Texella mulaiki</i> (2)
McDonald Cave	1/23/2013	TC										34			3					6			4				
McDonald Cave	8/20/2013	TC						1							1				6				1				
Midnight Cave	1/22/2013	COA								29						1											<i>Batrisesodes sp.</i> (2)
Midnight Cave	8/9/2013	COA								18						2					23						<i>Batrisesodes sp.</i> (2)
Millipede Annex Cave	6/12/2013	TC/COA						7											2		1	5					
Millipede Cave	6/12/2013	TC/COA																	2								
New Comanche Trail Cave	9/13/2013	TC	5										1														
North Root Cave	5/13/2013	TC						1											1							1	

			Endangered Species						Species of Concern										Other Significant Troglolobites								Other notable species detected
Cave	Survey Date	Monitoring Agency	<i>Neoleptoneta myopica</i>	<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Texanaurops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina ellioti</i>	<i>Cicurina trivisiae</i>	<i>Eidmannella reclusa</i>	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinnica</i>	<i>Rhadine subterranea</i>	<i>Speodesmus NS</i>	<i>Cicurina</i> sp. (blind)	<i>Eidmannella rostrata</i>	<i>Eidmannella</i> sp.	<i>Neoleptoneta</i> sp.	<i>Speodesmus bicornutus</i>	<i>Speodesmus</i> sp.	<i>Tartarocreagris infernalis</i>	<i>Texoreddellia texensis</i>	
Pickle Pit	4/26/2013	TC/COA																	1		1			1			<i>Texella</i> sp. (3) <i>Tartarocreagris</i> sp. (1) <i>Anapistula</i> sp. (2)
Pond Party Pit	1/16/2013	COA						21											3		4			5	1		
Pond Party Pit	8/6/2013	COA						6													14			7	3		<i>Rhadine</i> sp. (1)
Rolling Rock Cave	11/1/2012	COA																	9					1			<i>Perimyotis subflavus</i> (2)
Root Cave	5/13/2013	TC	2									2															
Seibert Sink	1/29/2013	COA																			18						<i>Tartarocreagris</i> sp. (2)
Seibert Sink	8/9/2013	COA								10				1										11		1	<i>Texella mulaiki</i> (1)
Slaughter Creek Cave	9/11/2013	COA								5						2								16			
Spanish Wells Cave	5/28/2013	TC/COA																200						1			<i>Stygobromus</i> sp. (~2000)
Spider Cave	11/1/2012	COA					1												22					2			
Spider Cave	6/4/2013	COA		1															48		3			3			
Starks North Mine	11/7/2012	TC												1													<i>Perimyotis subflavus</i> (12)
Starks North Mine	5/22/2013	TC												2													<i>Tartarocreagris</i> sp. (1)
Stovepipe Cave	1/16/2013	COA		2		2		21											11		3			42			<i>Tartarocreagris attenuata</i> (2)
Stovepipe Cave	8/6/2013	COA		3		9		28							1				11		6			30			<i>Tartarocreagris attenuata</i> (2)
Talus Spring Cave	8/27/2013	TC																									<i>Stygobromus</i> sp. (2)
Tardus Hole	11/29/2012	TC																									
Tight Pit Cave	2/6/2013	TC																									
Tooth Cave	11/16/2012	TC	4					33				22	3													1	<i>Perimyotis subflavus</i> (3)
Tooth Cave	5/15/2013	TC	1	1				27				17	3													4	
Two Trunks Cave	2/6/2013	TC																									
Weldon Cave	1/29/2013	TC					1	2				3					11						1				<i>Perimyotis subflavus</i> (2)
Weldon Cave	8/7/2013	TC						2				3					17										

			Endangered Species						Species of Concern										Other Significant Trogllobites								
Cave	Survey Date	Monitoring Agency	<i>Neoleptoneta myopica</i>	<i>Rhadine persophone</i>	<i>Tartarocreagris texana</i>	<i>Texanaurops reddelli</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Caecidotea reddelli</i>	<i>Cicurina bandida</i>	<i>Cicurina ellioti</i>	<i>Cicurina trivisiae</i>	<i>Eidmannella reclusa</i>	<i>Neoleptoneta concinna</i>	<i>Neoleptoneta devia</i>	<i>Rhadine austinica</i>	<i>Rhadine subterranea</i>	<i>Speodesmus</i> NS	<i>Cicurina</i> sp. (blind)	<i>Eidmannella rostrata</i>	<i>Eidmannella</i> sp.	<i>Neoleptoneta</i> sp.	<i>Speodesmus bicornoturus</i>	<i>Speodesmus</i> sp.	<i>Tartarocreagris infernalis</i>	<i>Texoreddellia texensis</i>	Other notable species detected
Whirlpool Cave	7/16/2013	TC/COA								1																1	<i>Tayshaneta sandersi</i> (1) <i>Texella mulaiki</i> (2)
Whirlpool Cave	9/16/2013	TC/COA								6											1						<i>Tayshaneta sandersi</i> (1) <i>Texella mulaiki</i> (2)

¹ All survey data and full species lists available by request through COA and TC

² Surveyors in FY13 include Todd Bayless, Erin Cord, John Chenowith, Renee Fields, Devin Grobert, Jason Hunt, Paul Fushille, Clifton Ladd, Mark Sanders, William Simper, Matt Turner, and Chris Warren.

EXHIBIT B:
CAVE CRICKET EXIT COUNT DATA REPORTS

FY 13 COA/TC CAVE CRICKET EXIT COUNT DATA REPORTS

Surveyed Caves	Fall 2012 (November)				Winter 2013 (January/February)				Spring 2013 (May/June)				Summer 2013 (August/ September)			
	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:	N:	J:	A:	TI:
Adobe Springs Cave	0	0	0	0					15	92	159	266				
Airmen's Cave					300	78	160	394					137	106	46	289
Amber Cave	68	41	27	136					199	48	41	288				
Broken Arrow Cave	336	113	271	720					337	201	210	748				
Cave Y					827	316	126	1269					59	40	32	131
Cold Cave					924	101	1	1025					594	86	57	737
Cortana Cave					98	9	6	113					4	7	23	34
Cotterell Cave					184	69	37	290					226	58	22	306
District Park Cave	417	136	42	595					891	594	557	2042				
Flintridge Cave	132	28	33	193					133	73	38	244				
Gallifer Cave					48	8	0	56					10	4	3	17
Geode Cave					50	13	0	63					80	78	45	203
Jest John Cave													123	192	293	608
Jester Estates Cave	429	48	956	572					228	31	17	276				
Little Bee Creek Cave	2	0	0	2					0	0	0	0				
Maple Run Cave					669	316	28	1013					185	43	12	240
McDonald Cave					2	4	0	6					0	0	0	0
Midnight Cave					7176	3514	546	11236					2861	2613	1220	6694
Pond Party Pit					290	33	39	362					104	41	784	929
Seibert Sink					48	39	4	91					385	191	82	658
Spider Cave	66	17	4	87					28	27	19	74				
Starks North Mine	4	1	5	10					1	12	83	96				
Stovepipe Cave					213	36	4	253					172	53	66	291
Testudo Tube					299	13	2	314					142	104	101	347
Tooth Cave	36	3	3	42					12	18	5	25				
Weldon Cave					285	200	94	579					1128	274	773	2175

N= nymphs; J= juveniles; A= adults; TI= total individuals.